

Quantifying off-highway vehicle impacts on density and survivorship of *Astragalus magdalenae* var. *peirsonii*, 2005

Disagreement about the impact of off-highway vehicles (OHVs) on the federally listed *Astragalus magdalenae* var. *peirsonii* (Peirson's milk-vetch) has spawned several investigations that arrived at seemingly contradictory conclusions. Aspects of study design vary tremendously among the investigations, affecting their scope of inference and management relevance. In the spring of 2005 The Carlsbad Field Office compared the density of *Astragalus magdalenae* var. *peirsonii*, or Peirson's milk-vetch, in areas open and closed to off-highway vehicles (OHVs). Additionally, a manipulative mark-recapture experiment was conducted to quantify the impact of OHVs on treatment and control plants. Our study objectives were to quantify the degree by which *A. m. var. peirsonii* densities differed between high- and low-OHV use areas and determine whether OHV impact was a plausible factor for affecting plant density. We therefore evaluated 1) *A. m. var. peirsonii* density differences between areas open and closed to OHV activity and 2) the effect of direct OHV impact on plant survivorship. Density estimate comparisons indicated that 4 to 5 times fewer plants occupied a study area open to OHVs relative to two nearby study areas located in interim closures off-limits to OHVs. A geographic information system (GIS) analysis of aerial photographs verified our assumption that vehicle use was higher in the OHV-open study area than the OHV-closed study areas. A manipulative mark-resight experiment compared the survivorship of control plants to those purposefully struck by OHVs and found that, for plants with canopy diameters of < 50 cm, OHV impact reduced survivorship by 33%. The experimental results offer indirect support for our hypothesis that direct OHV impact was at least partially responsible for the observed differences in *A. m. var. peirsonii* density between OHV-open and closed study areas. Seed-pod production estimates derived from the mark-resighting portion of the study suggest that overall seed production may have been depressed in the OHV-open study area relative to the two OHV-closed study areas. However, density estimates from one of the study areas recently closed to OHVs were surprisingly large, which may suggest that periodic closure of occupied habitat during favorably wet years would assist in ensuring *A. m. var. peirsonii* productivity and thereby persistence. An improved understanding of this phenomenon may indicate a dunes-wide management strategy that would allow OHV activity to coexist with *A. m. var. peirsonii*.